CASE REPORT PEER REVIEWED | OPEN ACCESS

A 55-year-old female presenting with central venous stenosis

Sabrina S. Sam, Karel T. S. Valenta

ABSTRACT

Introduction: Patients who have failed arteriovenous grafts (AVG) and arteriovenous fistulas (AVF) and are central venous catheter (CVC) dependent have a new option for hemodialysis access: the hemodialysis reliable outflow (HeRO) graft. Our patient required hemodialysis for end-stage renal disease (ESRD) secondary to uncontrolled diabetes. Case Report: A 55-year-old female presented with multiple AV fistula and AV graft failures due to venous outflow obstruction. She was catheter-dependent for hemodialysis access with evidence of central venous stenosis. The patient also presented with ventilator-dependent respiratory failure on pressure support ventilation and recurrent pleural effusions due to volume overload. With all other options exhausted, she underwent HeRO graft placement complicated by postoperative steal syndrome, and multiple thromboses. Conclusion: The HeRO graft is an option for long-term hemodialysis access for patients who are refractory to traditional approaches and are catheter-dependent. Thrombosis and steal syndrome may be more common complications of the surgery than previously suspected, but may be manageable if caught early. In comparison to central venous catheters, with the HeRO graft, infection rates are reduced and flow rate can be increased to manage fluid overload and pleural effusions. This case report should be of interest to Nephrology and Vascular Surgery specialties.

Keywords: Catheter-dependent, Central venous stenosis, Hemodialysis access, Hemodialysis reliable outflow (HeRO) graft, Steal syndrome

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INTRODUCTION

Central venous stenosis is a common problem in renal failure patients undergoing hemodialysis. Although functioning vascular access is crucial for hemodialysis patients, failure of vascular access is the most common cause of hospitalization in patients with stage 5 chronic kidney failure. Central venous stenosis jeopardizes arteriovenous fistula and arteriovenous graft access points as well as central venous catheters. The etiology behind central venous stenosis remains uncertain. Trauma and inflammation due to catheter placement are thought to be contributory factors. This leads to the development of micro thrombi, intimal hyperplasia and fibrosis [1].

The hemodialysis reliable outflow (HeRO) graft allows for a completely subcutaneous AV access option in people with limited possibilities. The HeRO graft consists of a tunneled graft connected to a reinforced outflow component designed to bypass venous stenosis. It has

been shown to be efficacious in patients who have failed traditional hemodialysis access options and are catheter dependent. HeRO grafts have also been shown to have lower rates of bacteremia compared to central venous catheters [2].

Common concerning complications of the HeRO graft include thrombosis and steal syndrome. Thromboses account for 82% of initial dysfunction with intragraft stenosis followed by an arterial anastomosis stenosis being the most common lesions identified [3]. Thromboses after HeRO insertion occur frequently and averages of 4.0 +/- 2.2 thrombectomies per graft are required [4]. The outcomes after thrombectomy are good although it carries a risk of pulmonary embolism after percutaneous intervention [3]. Recent studies have demonstrated dialysis access associated steal syndrome in 6.3–24% of patients who underwent insertion of the HeRO graft [2, 4]. This is much increased from the rate of 2.6% found in the early research conducted in 2009 [5]. In patients with multiple comorbidities, the rates may be as high as 24% [4].

CASE REPORT

A 55-year-old female was seen in the hospital with end-stage renal disease (ESRD) requiring hemodialysis with multiple failures of AVFs and AVGs and long-term catheter dependence. Our patient has a medical history significant for ventilator-dependent respiratory failure due to recurrent pleural effusions and pneumonia, morbid obesity, diabetes mellitus, hypertension, atrial fibrillation on warfarin and peripheral vascular disease with chronic bilateral stasis dermatitis.

The patient had central venous catheter hemodialysis for a duration of six months in 2008 after an infection of the foot. Then in February of 2012 she became permanently hemodialysis dependent. Her first point of access was a right-sided tunneled catheter. The catheter was used for bridging while attempting placement of AVFs and AVGs. An AVF in her left arm was constructed, but it never matured and was never utilized. Next, an AVG was inserted into her right arm. This was accessed only twice before it clotted and was deemed nonfunctional. Subsequently, an AVF on the right side failed due to clotting. A plan was then undertaken to create an AVF on the left that transcended the forearm and arm. This took an entire year to complete, and then failed after only two dialysis treatments. Subsequently, a left-sided AVG was constructed but access was never attempted due to clotting. By this time, the patient had required multiple changes in central venous catheters and had been catheter-dependent for over three years. Peritoneal hemodialysis was attempted twice and failed on both occasions. The patient refused any lower extremity interventions.

The patient underwent surgery for the HeRO graft in July 2015. The graft was successfully anastomosed to her right brachial artery with the outflow component coursing through the internal jugular vein and into the superior vena cava (Figure 1 Semi-upright Chest X-ray status post HeRO graft insertion). Immediately after the surgery, the patient began to complain of numbness and weakness in her right hand. Her radial pulse was markedly decreased and her hand was cold to touch. At first this was thought to be a normal reaction to the surgery but symptoms progressed to the point that the pulse was no longer palpable. She was taken into surgery for a suspected thrombosis. No thrombosis was found; rather, she was diagnosed intra-operatively with hemodialysis access associated steal syndrome. Proximalization of arterial inflow was utilized to restore perfusion to the hand and the steal syndrome was successfully resolved.

Hemodialysis was completed without issue the following day. She continued to receive successful hemodialysis treatments for one month until a thrombosis was discovered. An endovascular thrombectomy was completed without complication and dialysis was resumed. Another thrombus was found within two weeks and it, too, required percutaneous intervention.

Long-term patency of this patient's HeRO graft remains to be seen. Hemodialysis access with the HeRO has thus far been successful with increased flow rates but has been complicated by repeated thrombus formation as well as hypotension. There have been no repeated episodes of dialysis-access associated steal syndrome and no concern of infection. Increased fluid removal contributed to decrease in size of her pleural effusions. This aided in ceasing her pressure support ventilator and she is now successfully decannulated.

DISCUSSION

Although steal syndrome is a significant concern in all patients undergoing HeRO graft placement, the risk was

Figure 1: Semi-upright Chest X-Ray status post HeRO graft insertion. Chest X-ray showing placement of HeRO graft as well as bilateral pleural effusions that showed interval improvement compared to prior studies.

even higher in this patient due to multiple comorbidities and risk factors, including female sex, peripheral vascular disease, obesity, and diabetes. Steal syndrome may be prevented by using a more proximal artery for anastomosis. The risk of development of steal syndrome is higher with a brachial artery anastomosis so the axillary artery may be a superior choice in certain patients [6]. This highlights the importance of a creative surgeon and the customized approach to each patient.

The recommended treatment of thromboses occurring during initial graft maturation period of HeRO graft placement is surgical thrombectomy. Thromboses that occur after maturation can be managed with standard endovascular interventions [6, 7]. Maintenance treatment with clopidogrel or warfarin (with an INR of approximately 3.0) may help prevent thrombus formation. Hypotension may not only be a limitation to fluid removal during hemodialysis, but also a risk factor for thrombus formation. Systolic blood pressure ideally should be maintained at 120 mmHg on the right side and 140 mmHg on the left side due to the need for a longer conduit [6].

Leg AVGs may be an alternative to the HeRO graft as an end stage dialysis access solution. They have shown higher patency rates and less need for intervention. However, these too are complicated by the risk factors epitomized by this patient. Increased infection would also be a serious concern with permanent groin catheters, particularly in this setting of morbid obesity and diabetes. In addition, our patient refused to consider leg AVGs or femoral catheters as an option.

Another alternative if her HeRO fails to remain patent is a transhepatic catheter for hemodialysis access. These are designed to be moderate-term to long-term access options. The major complications include exit site infection, dislodgement, tip infection, and intra-catheter thrombosis. These occurred in 26%, 17.3%, 13%, and 13%, respectively [8]. Minor complications consist of intra-catheter air bubble and leakage, with rates of 13% and 8.7% [8]. Transhepatic access was proven to be durable with long-term functional ability, however, there are high rates of major and minor complications. A large amount of maintenance and intervention may be required to preserve patency [8].

The HeRO graft is an available option for patients who have failed attempts at AVFs and AVGs, are catheter dependent, and who have central venous stenosis. Rates of bacteremia are decreased and flow rates are increased. Thus, in successful HeRO grafts, quality of life is higher compared to tunneled dialysis catheters.

Early studies showed high patency rates with few complications, including thrombosis and steal syndrome. However, we believe there are higher rates of complication with thrombosis and steal syndrome than initially found. This is thought to be due to a population with high risk and multiple comorbidities.

CONCLUSION

Thromboses are a common complication and need to be addressed with either surgical or percutaneous interventions. Steal syndrome is a significant concern after HeRO graft placement, particularly in females with comorbidities such as peripheral vascular disease, obesity, and diabetes. Patients should be followed closely for the possibility of thrombosis and steal syndrome.

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Guarantor
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Conflict of Interest
Authors declare no conflict of interest.

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